Aquatic Plant Management
An Integrated Approach

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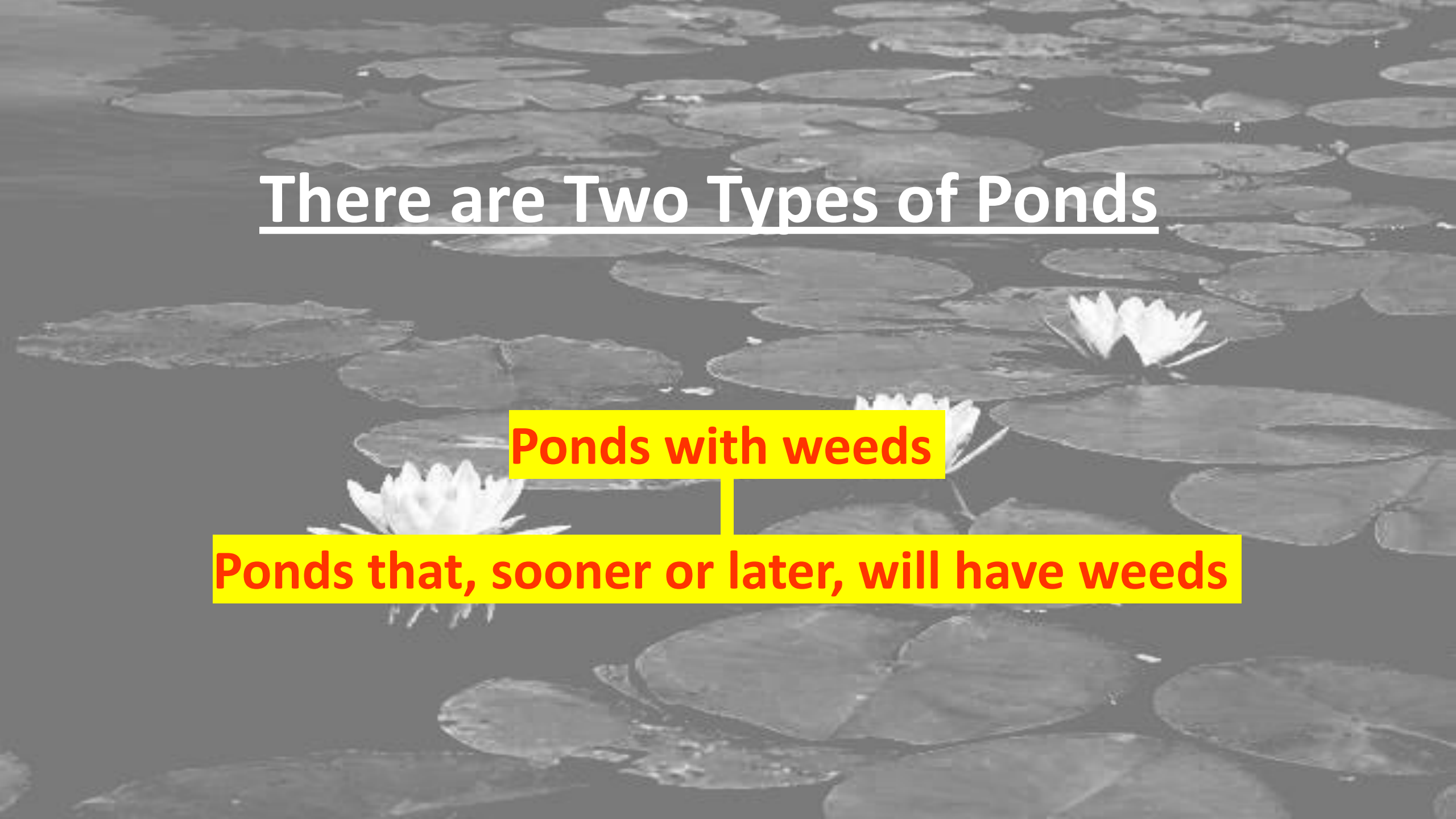
- Landshore

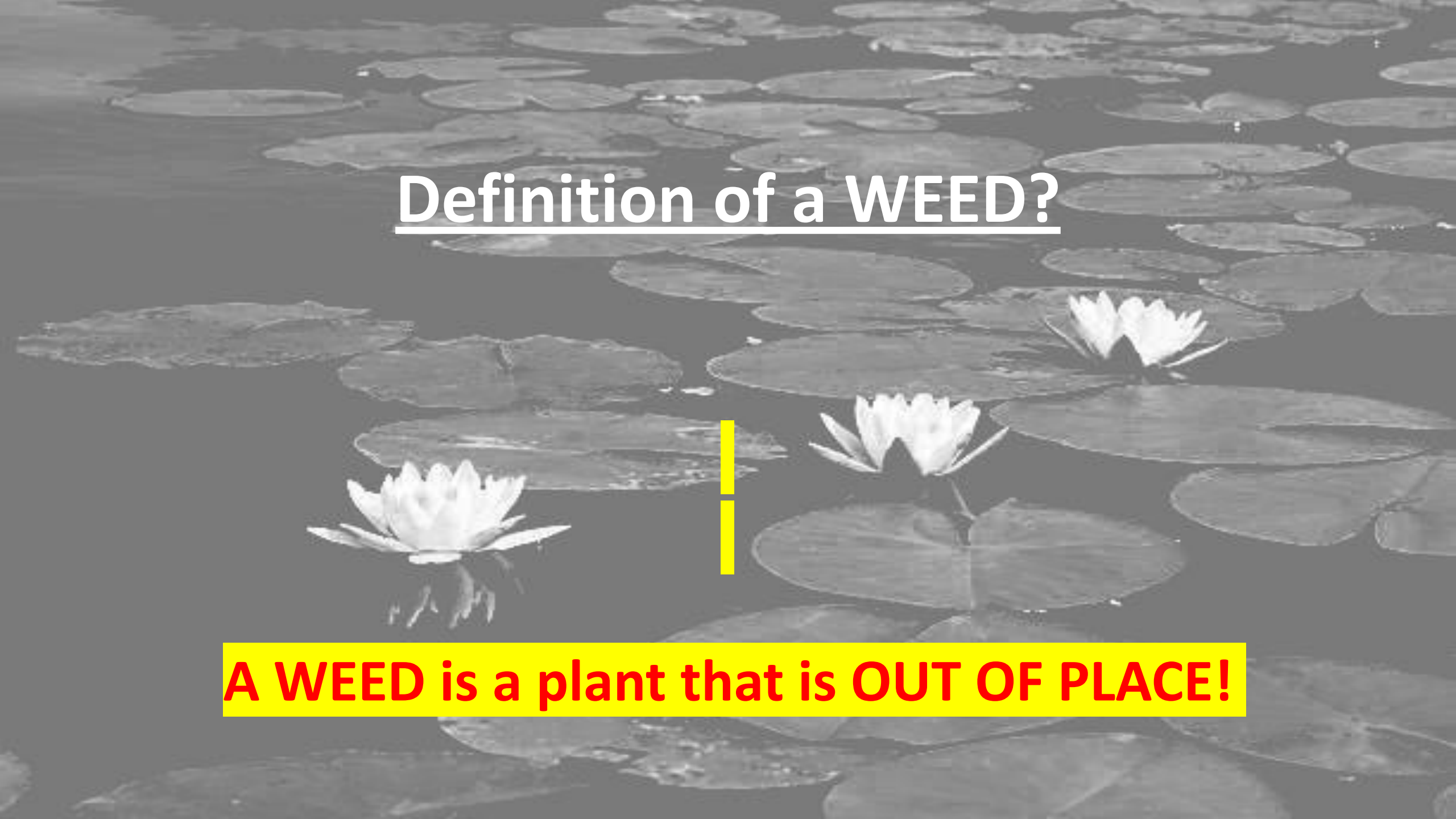


There are Two Types of Ponds

Ponds with weeds

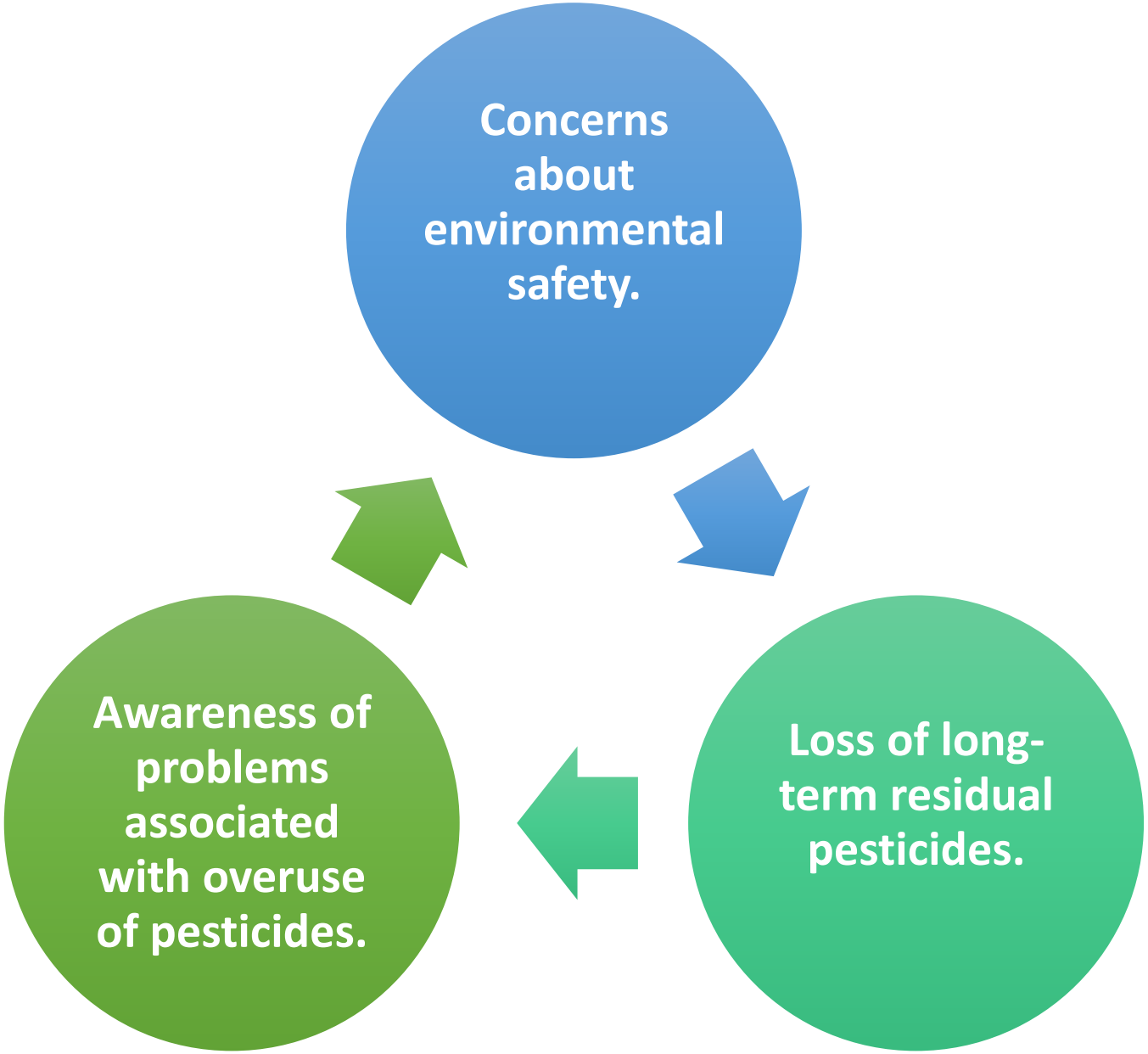
Ponds that, sooner or later, will have weeds

Definition of a WEED?



A WEED is a plant that is OUT OF PLACE!

Why Use IPM Practices?



What Does IPM Include??

Encourage

- Encourage use of cultural practices.

Use

- Use of pesticides only when needed.

Encourage

- Encourage use of biological controls.

Encourage

- Encourage use of mechanical controls.

Benefits of *IPM*

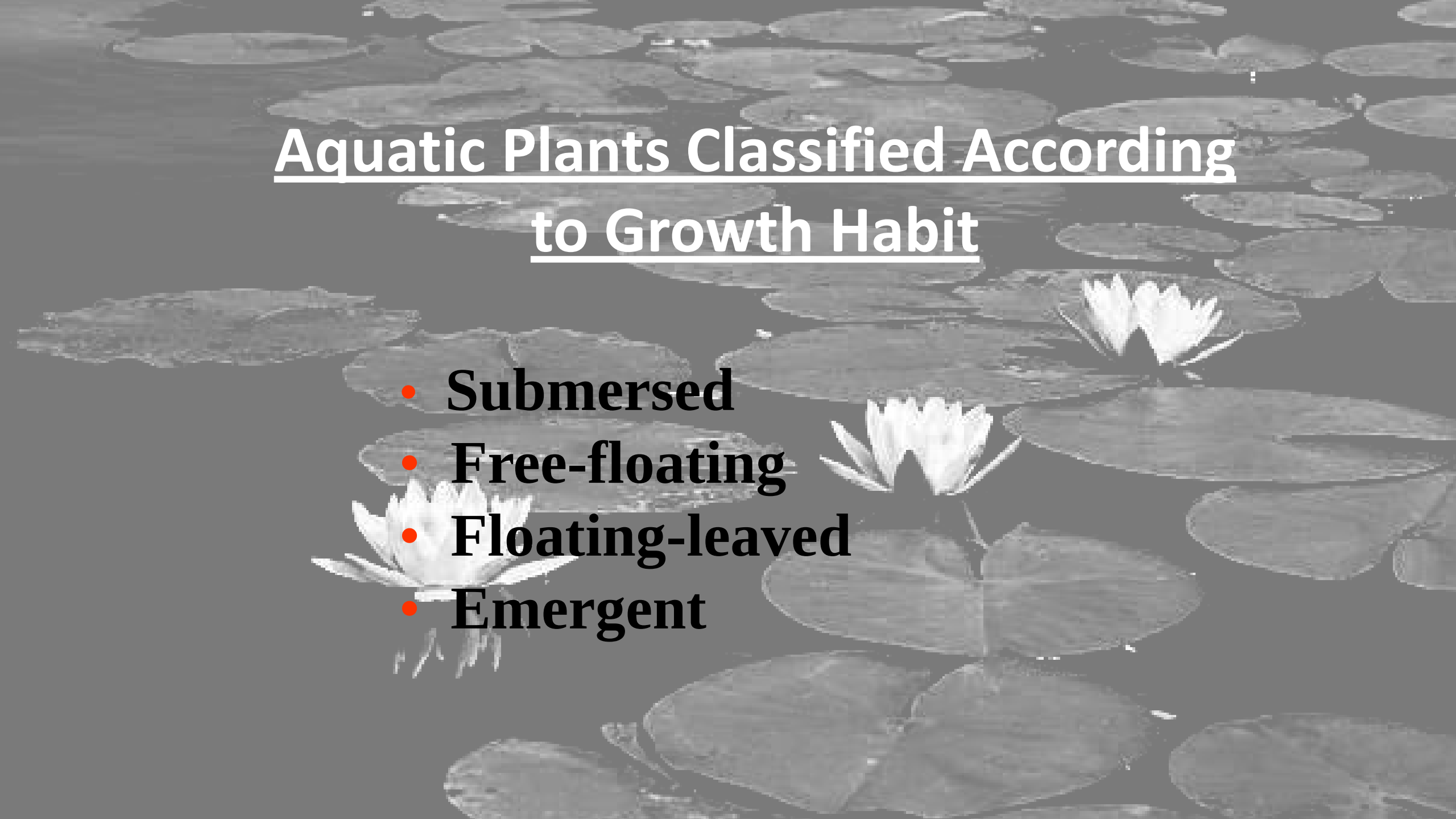
- **Least disruptive control is first choice**
- **Least adapting/damaging to water quality**
- **Least likely to cause pesticide resistance**
- **Most likely to produce long term pest suppression**
- **Most likely to be cost-effective in the long term**

Importance of Aquatic Plants

- Food, shelter, resting, and breeding habitat for fish, waterfowl, and other wildlife
- Protection against shoreline erosion
- Oxygenation of water
- Aesthetics

Importance of Aquatic Plant Identification

- Distinguish between desirable and undesirable species
- Assure that the proper management options are selected for the target species
- Adjust management strategy to impact the target weeds at most critical points in their life cycles and to minimize adverse impacts on non-target species



Aquatic Plants Classified According to Growth Habit

- **Submersed**
- **Free-floating**
- **Floating-leaved**
- **Emergent**

Prevention

- Proper Pond Location
- Proper Pond Design and Construction
- Regular Maintenance
- Avoidance of Weed Introductions

Overview

- Land Management Practices
- Water Management Practices
- Manual Removal
- Biological Control
- Chemical Control
- Incorporating Multiple Practices

Land Management Practices

- Slope Management
- Pond Borders
- Effective Fertility
- Wildlife and Livestock

Slope Management

- No bare spots!
  - Increase mower height
  - Rotate grazing
  - Prep. & Plant
- Species?
  - Warm Season + Cool Season
  - Cool Season
- Winter vegetation
  - Winter water recharge climate
  - Remember SC gets most of its rainfall in Fall and Winter Months.

Pond Borders

Effective Fertility

- Soil Test!!!!!!!!!!!!!!
- Apply required nutrients only

- Soil test reports 100 lbs N, 0 lbs P, and 30 lbs K are needed
  - If using 10-10-10
  - You add 100lbs of unnecessary P
  - You add 70lbs of unnecessary K

Wildlife and Livestock

- Ducks and Geese
  - Discourage feeding
  - Round ups
  - Egg treatments
- Wild Hogs
  - Trap
  - Shoot
  - Fence
- Livestock
  - Fence out

Water Management Practices

- Fertility
- Pond Dye
- Phosphorous Management
- Floating Islands

Pond Fertility

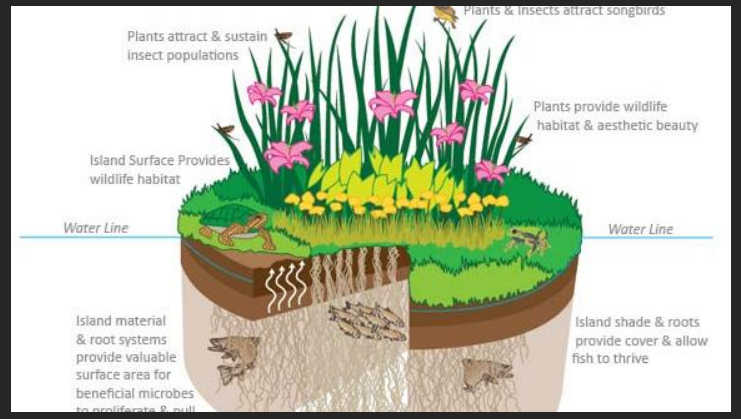
- Begin fertilizing Spring @ 65°
  - Granular – 40lbs 20-20-5
  - Liquid – 1-2gal 10-34-0
  - Powdered – 2-8lbs 10-52-0
- Monitor bloom
  - Secchi disk readings 18-20”
- Problems
  - Over fertilizing favors blue-greens
  - Algaecides kill green algae

Pond Dye

- Lots of brand and color options
- Substitute for fertilizing
  - Great option when fertilizing is not an option.
    - Following algaecide application
    - Presence of weed problems
- Not recommended for intensively managed fisheries
  - Negatively impacts zooplankton populations

Phosphorous Management

- **Lanthanum laden clays**
- **Permanently bind P and sink out of water** column



Floating Islands

Manual Removal

- **Land based machinery**
- **Aquatic harvesters**
- **Hand tools**

Hand Tools

- **Great option for small ponds**
- **Inexpensive**
- **Compost or mulch with harvested weeds**

Land Based Machinery

- Pros
  - Chemical free?
  - Readily available
    - Rental or Purchase
    - Most contractors and grading companies have them
  - Remove substantial volume in short time
- Cons
  - Expensive
  - Only remove what they can reach
  - Damage to pond edges
  - Bycatch
  - What to do with harvested weeds
  - Fragmentation concerns

Aquatic Harvesters

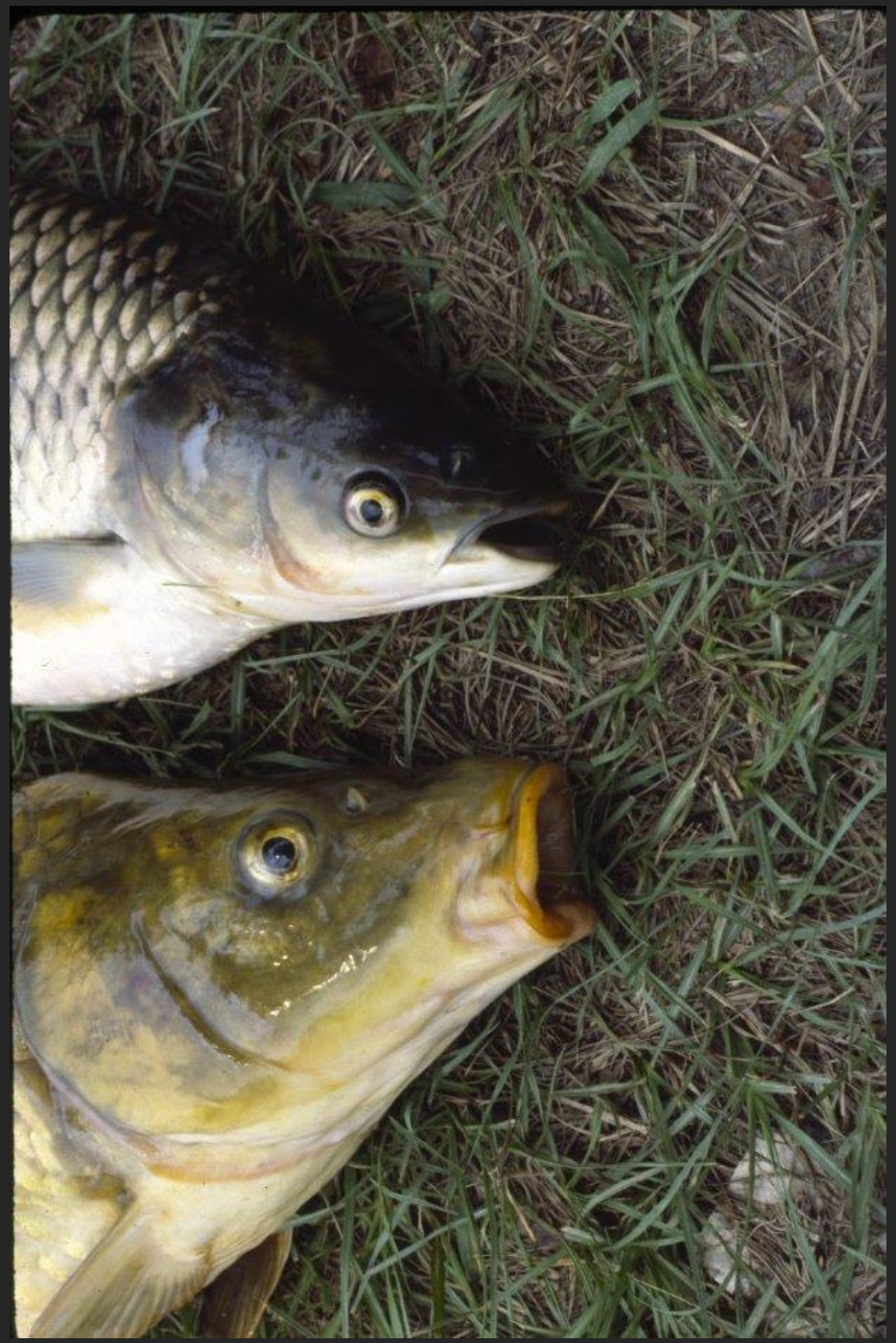
- Pros
  - Chemical free?
  - Fast removal of weeds
  - Effective in most water depths
- Cons
  - Availability/cost
  - Bycatch
  - Disposal of weeds
  - Fragmentation concerns

Biological Control

- Species Available
  - Tilapia
  - Triploid Grass Carp
  - Alligatorweed Fleabeetle
- Pros
  - Chemical free
  - Cost efficient
  - Fishery supplement
- Cons
  - Not effective on all weeds
  - Slow results
  - Permits required
  - Restocking required

Triploid Grass Carp

- *Ctenopharyngodon idella*
- Overwinter well
- 5 years of quality service
- May live 20 years and reach weights in excess of 30 lbs
- Primarily feed on aquatic macrophytes
- Preferred plants include: Spikerush, Chara, Pondweeds, and Naiads



Tilapia

- **Tilapia**
  - **Blue (*Oreochromis aureus*)**
  - **Nile (*Oreochromis niloticus*)**
  - **Red-Bellied (*Tilapia zillii*)**
- **Stocking**
  - **April-May @ 200-400/acre**
- **Cold Tolerance**
  - **Lethal Limit ≈ 50˚F**

Chemical Control

- NPDES Requirements
- Effective Chemistries
- Water Use Restrictions
- Selecting the Right Herbicide
- Pros and Cons

How would you describe the “ideal pesticide?”

- Only kill the target pest
- Not cause genetic resistance in the target organism
- Disappear or break down into harmless chemical
- Cost effective

Pesticides in an IPM Program

- Select carefully – Choose one with least environmental precautions – Site Specific
- Time application to most sensitive stage of the pest
  - Frequent Monitoring
- Spot treat problem areas if possible
- Calibrate application equipment often
- Understand application methods
- Follow precautionary statements
- Use treatment thresholds

Chemical Control Pros

- Pros
  - Fast results
  - Many options
  - Effective
  - May be only option for some species
  - SAFE – EPA Approved
  - Trained Applicators
  - Regulatory Oversight

Disadvantages of Chemical Control

- Accessibility
- Limited choice of products
- Some very expensive
- May damage desirable vegetation
- Limited contact time due to dilutions and flow
- Off-target movement of chemicals with water flow
- Localized oxygen depletion
- Nutrient release from dying and decaying weeds
- Damaged weeds may float away and root elsewhere
- Herbicide persistence and toxicity problems

EPA – Two Regulatory Pathways for Aquatic Pesticides

- Federal Law
  - Marriage of Clean Water Act and Federal Fungicide, Insecticide, and Rodenticide Act
  - Both - EPA Regulations
  - FIFRA – Administered by Clemson Dept. Of Pesticide Regulation
  - NPDES - Administered by SCDHEC
- Permit Requirements
  - General Permit
    - Less than 200 acres or 20 miles of shoreline.
- Above Thresholds
  - Notice of Intent (NOI)
  - Integrated Pest Management
  - Pesticide Discharge Management Plan

Effective Chemistries

- 2,4-D
- Bispyribac
- Carfentrazone
- Copper
- Diquat
- Endothall
- Flumioxazin
- Fluridone
- Glyphosate
- Imazamox
- Imazapyr
- Penoxsulam
- Sodium Carbonate Peroxyhydrate
- Topramezone
- Triclopyr
- Florpyrauxifen-benzyl

Water Use Restrictions

- **Herbicides may require a waiting period before treated waters may be used for various activities.**
  - **Irrigation**
  - **Fish Consumption**
  - **Watering Livestock**
  - **Swimming**

Water Use Restrictions

Associated with each herbicide (except copper formulations) are one or more water use restrictions.

- Fishing (consumption of fish or use for fish meal)
- Swimming (any activity which immerses the body)
- Irrigation (including use for preparation of agricultural pesticidal sprays)
- Livestock watering (may include humidification of poultry houses)
- Domestic drinking water supplies (a setback distance also may apply)

Factors Affecting Application Rate of Aquatic Herbicides

- **Density of weeds**
- **Amount of water exchange in the treatment area**
- **Sensitivity of the most resistant weeds species present**

Physical and Environmental Factors Affecting Herbicide Efficacy

- **Weather conditions - wind, rainfall, temperature**
- **Water movement (affects contact time)**
- **Water chemistry - turbidity, alkalinity, pH, certain divalent metal ions (Mn, Fe)**

Timing of Treatments

- **Early treatment is desirable for most weeds.**
- **Weeds are smaller and require less herbicide.**
- **Plants are actively growing, and herbicide uptake and activity is faster.**
- **There is less plant material to decay.**
- **Water is cooler and holds more oxygen - less chance of a fish kill from oxygen depletion.**
- **Some fall applications during flowering.**

Weed Management Decisions

- Plant identification
- Budget and Equipment
- Control Period - Speed and Duration
- Use of the body of water (irrigation, potable water, livestock, fishing)
- Physical, environmental, and economic constraints
- Water quality
- Fish & wildlife populations (threatened & endangered species)

Questions

- Applicator License?
- Water Use Restrictions?
- Downstream Uses?
- Ownership?
- Local Ordinances?
- Regulatory Buffers?
- Read and Follow The Label?

Weed Type	Effective Chemistries (Please check label, product effectiveness may vary by species.)
Algae	Copper, Diquat, Endothall, Sodium Carbonate Peroxyhydrate
Floating Plants	Fluridone, Penoxsulam, Flumioxazin *Several other chemistries are effective on Water Hyacinth
Emergent Plants	2,4-D, Bispyribac, Carfentrazone, Diquat, Flumioxazin, Fluridone, Glyphosate, Imazapyr, Imazamox, Penoxsulam, and Trichlopyr
Submerged Plants	2,4-D, Carfentrazone, Diquat, Endothall, Flumioxazin, Fluridone, Penoxsulam, and Triclopyr

Selecting the Right Herbicide

Web Resources in Aquatic Weed Management

- Texas A&M University - Aquaplant **https://aquaplant.tamu.edu**
- U. of Florida, Center for Aquatic and Invasive Plants: http://aquat1.ifas.ufl.edu/
- Corp of Engineers, Aquatic Plant Control Program: http://www.wes.army.mil/el/aqua/

Pesticide Recordkeeping and Application Information Disclosure

- **Each application record must include ("data elements"):**
  - **the quantity of each pesticide used, received, or purchased**
  - **the common chemical name of the active ingredient (*not* the product name)**

Pesticide Recordkeeping and Application Information Disclosure

- GOOD application records let you:
  - duplicate successes,
  - trouble-shoot application problems or control failures, and
  - can help manage your pesticide inventory.

Pesticide Recordkeeping and Application Information Disclosure

- Keep information beyond the regulatory requirements that is useful to *you!*
  - Weather conditions temperature, wind direction and speed (outside applications),
  - method of application,
  - pump pressure, nozzle tip type and size, application rate, equipment settings.

Pesticide Recordkeeping and Application Information Disclosure

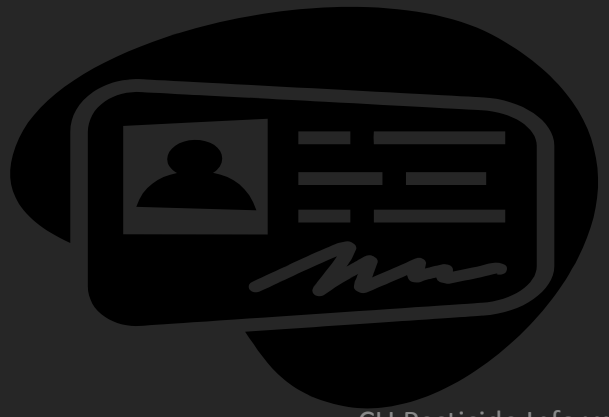
- **Should your customer make a request, all structural and general household pest control operators and custom ground applicators –** ***including commercial agricultural applicators, lawn, golf course, ornamental plant and tree pesticide applicators, and all other types of commercial and non-commercial pesticide applicators –*** **must provide the customer with…**

Pesticide Recordkeeping and Application Information Disclosure

- A complete, fully legible, statement about any application of pesticides on their property under their ownership or control.

Pesticide Recordkeeping and Application Information Disclosure

- **The statement must contain, **at a minimum*,**
  - **the name of the company or firm and their address.**
  - **The pest or pests to be controlled.**
  - **The common chemical name of the active ingredient(s) (*not* the brand name) of the pesticide applied.**
  - **The name of the responsible licensed applicator.**



Pesticide Recordkeeping and Application Information Disclosure

- ***at a minimum…*** **Other reasonable information requested may be:**
  - **Product name**
  - **Antidote, first aid info, other emergency information on the label.**
  - **Description of how the pesticide was being used.**
  - **How an exposure may have occurred.**
  - **Conditions at application; Precautions taken.**

IPM

Situation 1

HOA 6 acre impoundment with 12 residential sites. Problem species include filamentous algae and Parrot feather.

Options

- Require lawn and landscape fertilizing be done in accordance with soil test.
- Require vegetated buffer a minimum of 15 feet around pond perimeter, one access per residence.
- Annual stocking of 1200 tilapia in April or May.
- Install floating islands.
- Contract with commercial applicator to spray Parrot feather with labelled herbicide.

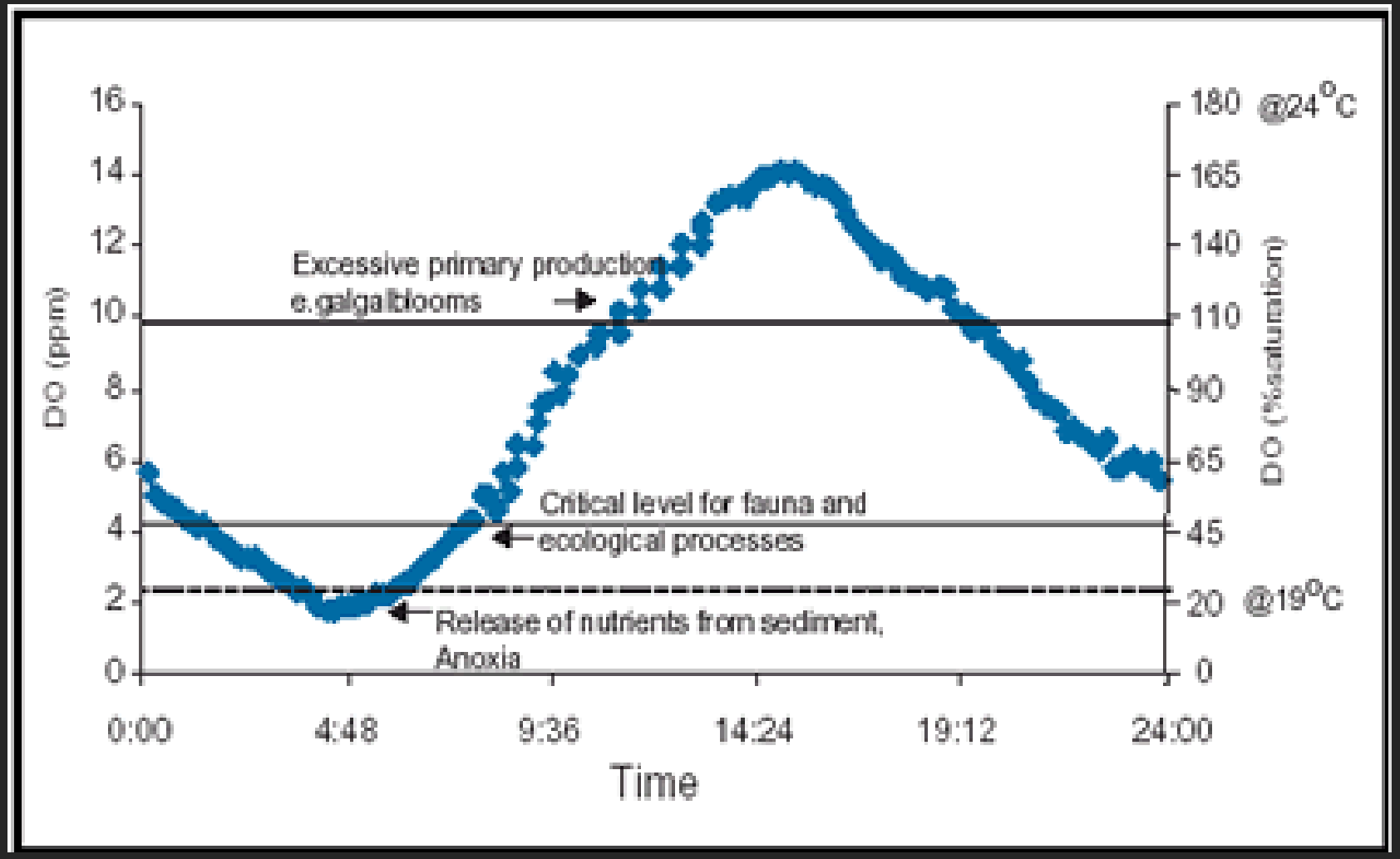
IPM

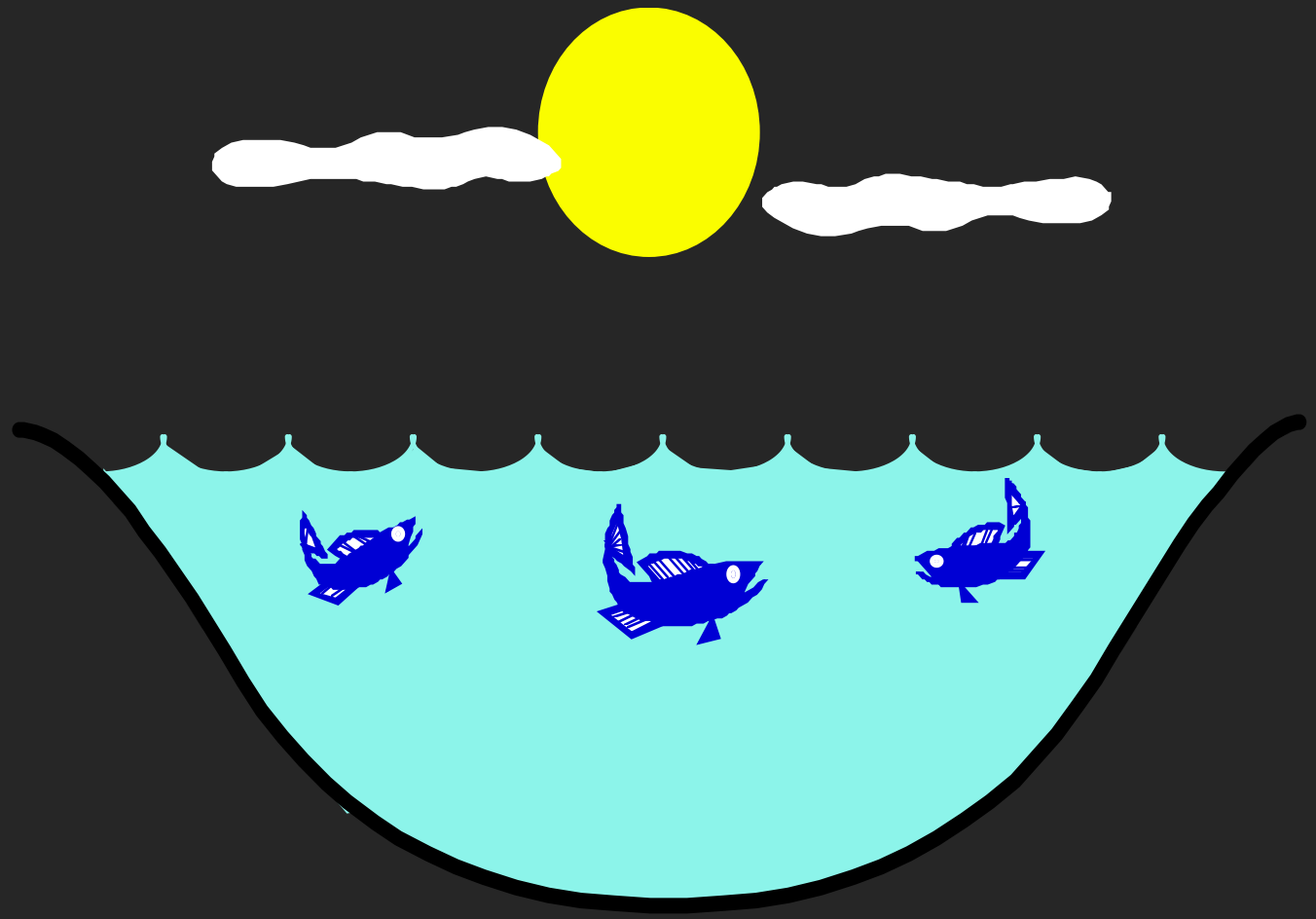
Situation 2

Stormwater pond approximately 1 acre with an average depth of 6 foot at full pool. Pond has sufficient border in place. Problem species are blue-green algae.

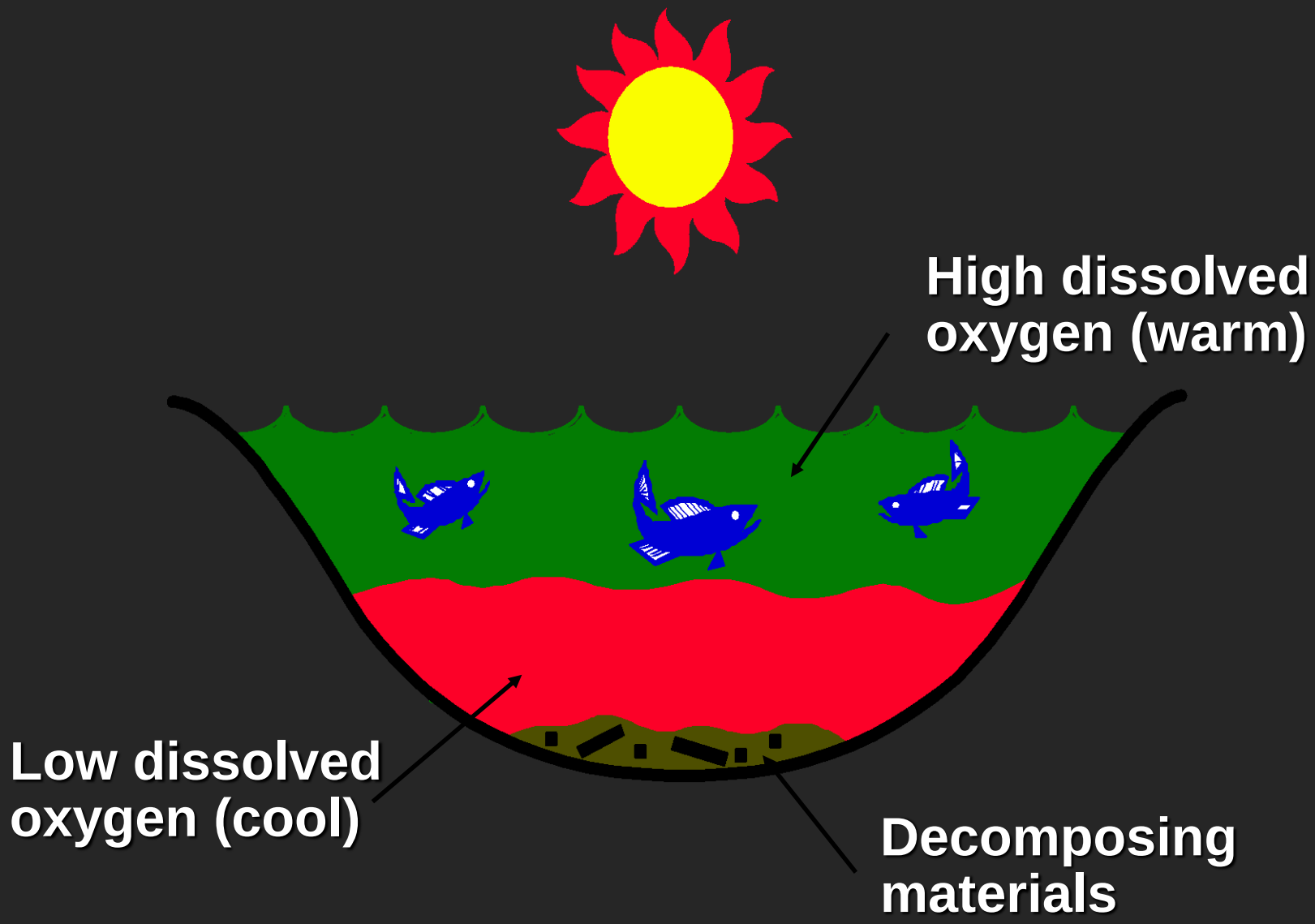
Options

- Stock 400 blue or nile tilapia in April or May.
- Install floating islands.
- Make application of sodium carbonate peroxyhydrate.
- Apply a phosphorous binding agent.

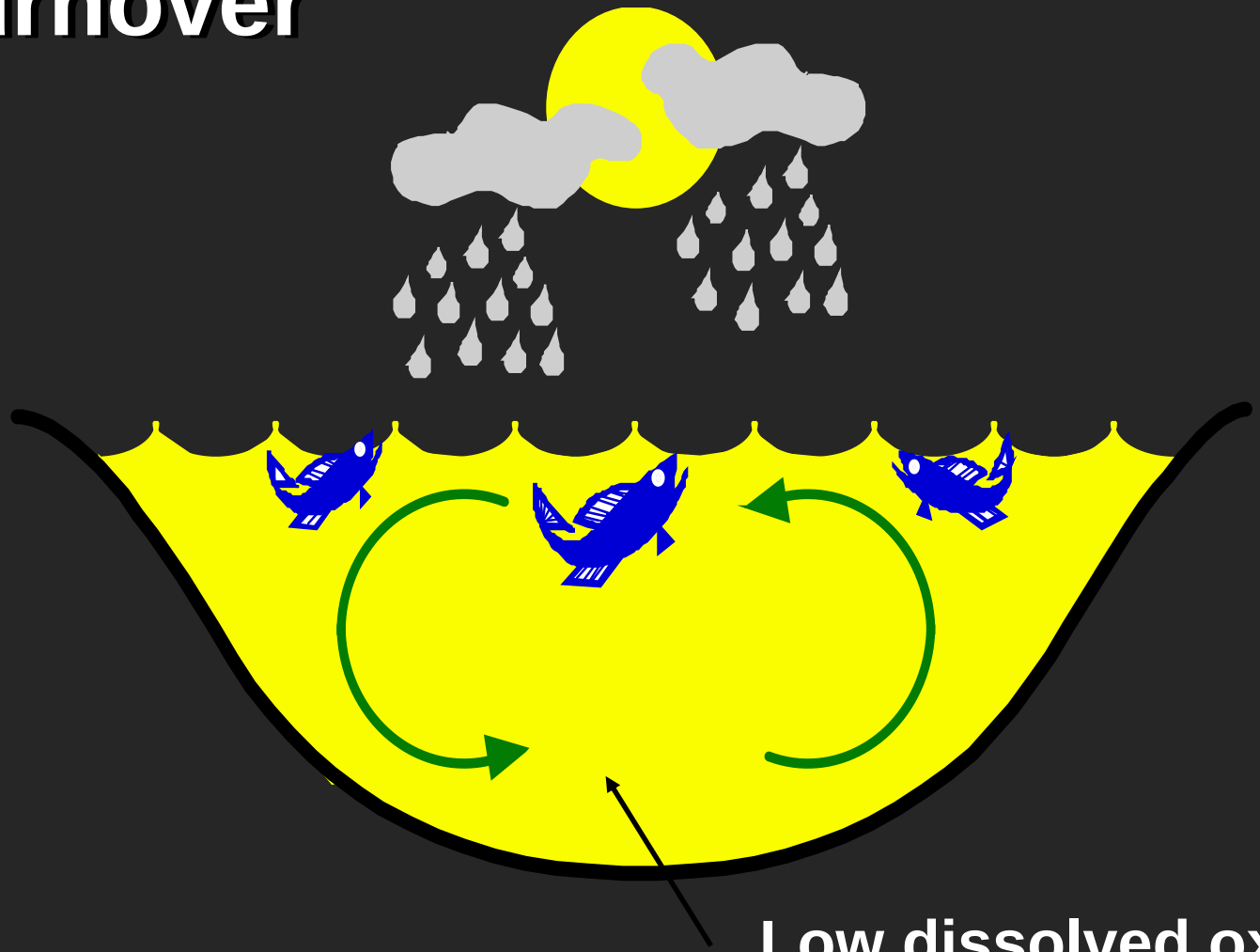

16
14
12
10
8
6
4
2
0
DO (ppm)
180
165
140
110
90
65
45
20
0
@24°C
@19°C
DO (%saturation)
Excessive primary production
e.galgalblooms
Critical level for fauna and
ecological processes
Release of nutrients from sediment,
Anoxia
0:00
4:48
9:36
14:24
19:12
24:00
Time



Uniform dissolved O_2 in pond


High dissolved oxygen (warm)
Low dissolved oxygen (cool)
Decomposing materials

Turnover



Low dissolved oxygen - possible fish kill

Three Major Causes of Fishkills

- **Oxygen depletion**
- **Toxic algae bloom**
- **Pesticide toxicity**

Time of Fishkill

- **DO - Night/Early Morning**
- **TAB - Bright sunlight - 9am - 5pm**
- **Pesticides - Any time**

Fish Size

- **DO - Large fish first**
- **TAB - Small fish first**
- **Pesticides - Small fish first**

Causes of Fish Kills

- Most fish kills (> 99%) due to oxygen depletion
  - **Fish kills from nighttime oxygen depletion is common in summer, particularly during extended periods of hot, cloudy weather followed by heavy rainfall**
  - **Fish kills caused by oxygen depletion may occur after herbicide applications when:**
    - **Treatment occurs too late in season**
    - **Too much of the weed growth treated at one time**
- Very few fish kills (< 1%) from herbicide toxicity
  - **Caused largely by excessive application rate**
  - **Sometimes caused by use of inappropriate products**

Questions - PLEASE